DISSERTATION ON

ANALYSIS OF INTRA CRANIAL MENINGIOMA BASED ON THE PATHOLOGICAL TYPE WITH PARTICULAR REFERENCE TO THE OUTCOME

Submitted by
Dr.R.RAJU

M.Ch., Degree Examination
Branch I - Neurosurgery

The Tamilnadu Dr.M.G.R. Medical Univeristy
Chennai.

February - 2006

CERTIFICATE

This is to certify that the dissertation entitled **"ANALYSIS OF INTRA CRANIAL MENINGIOMA BASED ON THE PATHOLOGICAL TYPE WITH PARTICULAR REFERENCE TO THE OUTCOME"** was done under our supervisor and is the bonafide work of Dr.R.RAJU. it is submitted in partial fulfillment for the M.Ch. Neurosurgery Examination.

Prof.KALAVATHY PONNIRAIVAN
B.Sc., M.D.
The Dean
Madras Medical College & Government General Hospital, Chennai - 600 003.

Prof.R.NANDAKUMAR
M.S., M.Ch.,
Prof. of Neurosurgery
Institute of Neurology
Madras Medical College & Government General Hospital
Chennai - 600 003.

ANALYSIS OF INTRA CRANIAL MENINGIOMA BASED ON THE PATHOLOGICAL TYPE WITH PARTICULAR REFERENCE TO THE FUNCTIONAL OUT COME

CONTENTS

INTRODUCTION :

Many studies have been done correlating the outcome of Meningioma surgery with reference to location of the tumour and extent of the Surgical Removal. Few studies have been done Analysing the outcome of Meningioma Surgery Correlating with the Pathological type of Tumour ENCOUNTERED. Hence this study attempts to correlate the various FEATURES of presentation, Radiological FINDINGS, FUNCTIONAL OUTCOME with reference to pathological type in addition to the location and extent of Tumour Removal.

AIM OF STUDY :

I. To analyse the symptoms and radiological findings with reference to pathological type.

II. To study out come in various pathological Type of Meningioma in relation to symptomotalogy, radiological findings, location and extent of tumour resection and functions.

REVIEW OF LITERATURE :

Subsequent review of Literature regarding outcome following Meningioma Surgery shows that these studies falls broadly into three types.

(1) Those Analysing the effect of location of the Tumour and outcome.

(2) Those Analysis the effect of Amount of Surgical Removal and outcome.

(3) Those analysing the pathological nature of the Turmour with reference to recurrence.

Few studies have been done analyzing the Symptomatology, Radiological findings, Functional outcome in Tumour location and Turmour resection all correlating with pathological type of Turmour under one study.

An "Important study, by Richard Chain (1984) (Ref…..) Analysing the morbidity and mortality following Intracranial Meningioma study taking into the account of pathological nature of Meningioma only the difference between benign and malignant variety" – Richard C.Chain.

According to the study there was no significant outcome among various benign histological type of Meningioma.

No comparison has been made between the Benign and Malignant Histological type.

J.Neurosurg. 1984 Jan; 60 (1) : 52-60. Related Articles, Links.

Richard C.Chan, M.D. and Cordon B, Thomson M.D. FRCS (4) concluded that multiple factors including the size and location of Tumours, the degrees of Tumour excision, the histological features and the pre operative condition of the patient are important in both duration survival and quality of life following surgery for intracranial Meningiomas.

Jan M, Bezeze V, Sandean D, Autret A, Betrand P, Gouze A – Authors (1) concluded that the operative mortality rate was 14.31 with very peak in the six decade reaching 27% while it was 13% in those over seventy. The Internal sphenoid ridge location had mortality rate of 31.5, which is significantly higher than for all other locations.

Neurosurg Rev. 1998; 21 (2-3) : 106-10. Related Articles, Links.

Neurosurg Rev 1998 (2) results suggested that complications and mortality were mostly related to location and large volume, they also had have problem with aggressive and malignant meningiomas.

Jaaskelainen J, Haltia M, Serw A (3) concluded that recurrence rate more in Anaplastic Meningioma.

J.Neurosurg. 1996 Mar; 84 (3): 382-6. Related Articles, Links.

Chozick BS, Reinert S.E on the basis of their finding the Authors (5) concluded that earlier detection and treatment of supra tentorial Meningioma improve seizure outcome in patient with pre operative Epilepsy.

Mayo Clin Proc. 1998 Oct; 73 (10); 936-42)

Stafford SL, Perry A, Suman VJ, Meyer FB, Schithauer BW, Lolse CM, Shaw EG. Division of radiation oncology, Clinic Rochester, Minnesota 55905, USA (6) concluded that with only operative treatment of meningioma the 10-year recurrence rate was 25% in patient who had GTR (Gross total resectikon) and 61% in those who had less than GTR.

Turgut, Ozcan OE, Benli K, Ozgen T, Gurcay O, Bertan V, Erbengi A, Saglam S. Neuro Surgical unit Hacehepe University Hospital, Ankara Turkey (7) concluded that operative mortality and recurrence rate are affected by the intracranial location of the Tumoar, Histological type and extent of Tumour removal.

Acta Neurochir (Wien). 1988’ 90 (3-4);

Djindjian M, Caron JP Athayde AA, Ferrier MJ, Department Neurosurgery Hospital Henri Mondor, Creteil, France Concluded that two parameters seem essential for quannfying surgical risk, clinical status, edema and mass effect, evaluated by CT Scan. The best condition seem combined when Karnofsky rating scale is higher that or equal to 50 No. or only limited perifocal hypodensity and without mass effect. Although Meningioma may remain dormant for many years or can be kept under control medically for some time, the development is unpredictable.

Epilepsy Res. 2000 Jan; 38 (1) ; 45-52. Related Articles, Links.

Lien AS, Howng SL Department of Neurosurgery, Kaosiung Medical College Hospital Kaosiung city Tiwan ROC (9) concluded that regarding pre operative existing factors, Intracranial Meningiomas located at supratentorium, convexity and wish evidence of or severe peritumoral edoma significant contributed to pre operative Epilepsy. And in patients with pre operative Epilepsy, thos tumors with evidence of or severe perifocal edema and cerebral edema at the operative site were significantly more likely to sufferfrom post operative Epilepsy.

J.Neurooncol 1992 Jun 13(2) : 177-81. Related Articles 1 Links.

Sachsenheimer W, Piotrowski W, Bimmler T. Fakultat Fur Llinische Medizin Mannheim, Heide berg, Germany (10) concluded that a performance status improvement up to 80 could be obtained in patient with Meningiomas however, 35% were left unfit for work.

Maurice – Williams RS, Kitchen MD Royal Free Hospital, Hampstead, London, UK (11) concluded that age has little effect on the prospect of success after removal of an intracranial Meningioma.

Coke CC, Lorn BW, Warner - Wasik M, Yiey, Curran WJ Jr. Department of Radiation Oncology, Thomas Jefferson University Hospital Philadelphia, Pennsylvania 19107 USA (12) concluded the long time survival is possible for patients with Atypical and malignant Meningioma treated with surgery and post operative radiation. They are unable to distinguish a difference in outcome between these two pathological entities. Br.J.neurosurg. 1962; 6(2); 131-7 related Articles, Links Intracranial Tumours in the elderly: the effect (13) of age on the outcome of First time surgery for meningioma.

In 1938 wishing and Eisenhardt's published monograph of meningiomas in which they reported in detail the cases of 313 patients encountered between 1903 and 1932. They have concluded that there is today nothing in the while realm of surgery more gratifying than successful removal of Meningioma with subsequent perfect functional recovery those word are still true more than 80 years later.

MATERIALS AND METHODS :

This study, analyzing total number of 59 cases of Intra Cranial Meningioma operated in Madras Institute of Neurology between July 2003 to December 2004.

For the purpose of this study, meningioma was classified as belonging to the following locations (I) Convexity (II) Falx (III) Medial sphenoid Wing (4) olfactory (5) Para Sagital (6) pterional (7) Tentorial.

The following Pathological type of tumour were encountered in this study.

- 1) Angioblastic Moningioma
- 2) Atypical Meningioma
- 3) Meningothelial Meningioma
- 4) Fibrous Meningioma
- 5) Fibro blastic Meningioma
- 6) Microcystic Meningioma
- 7) Syncytial Meningioma
- 8) Transtitional Meningioma

A) Surgical resection was classified as total when 100% Tumour removed.

B) Sub total when between 50-90% of the Tumour was excised and as

C) Partial when less than 50% of the Tumour was removed.

INCLUSION CRITERIA :

- First time surgery at the Madras Institute of Neurology.
- Elective Surgery.

EXCLUSION CRITERIA : The following patients were excluded

- Patient under going Surgery for recurrence and patient operated first time elsewhere
- Patient who died before surgery.
- Patient not willing for Surgery.

Patient who had associated other CNS problem like Hydrocephalus and Trauma.

- Patient who did not come for follow up.

The Tumor types are classified as :

- Angioblastic Moningioma
- Atypical Meningioma
- Meningothelial Meningioma
- Fibrous Meningioma
- Fibro blastic Meningioma
- Microcystic Meningioma
- Syncytial Meningioma
- Transtitional Meningioma

Each of the pathological type was further Analysed with reference to:

1) Age of the patients.
2) Symptoms such as Fits, Headache.
3) Level of consciousness.
4) Focal Neurological Deficit.
5) Radiological Finding
6) Time Interval between on set of symptoms and surgery.
7) Location of the Tumour.
8) Extent of surgical resection.

9) Effect of radiotherapy
10) Functional outcome was studied with respect to pre operative and post operative status using Karnofsky performance scale. The post operative Karnofsky scale was assessed 6 months after surgery.

Patients were analysed by using describing statistic student – T Test and Chis quase pearson statistical methods.

PROFORMA

NAME :

AGE :

SEX :

IP NO.

CLINICAL FEATURES :

SYMPTOM DURATION :

HISTOPLATHOLOGICAL TYPE :

LOCATION :

SURGICAL RESECTION :

TOTAL :

PARTIAL :

SUB TOTAL :

C T FINDING/MRI :

RADIO THERAPHY :

KARNOFSKY SCALE ASSESSMENT :

PRE OPERATIVE :

6 MONTHS AFTER SURGERY :

MASTER CHART

1	2	3	4		5		6		7	8	9	10
			Pre	Post	Pre	Post	Pre	Post				
1	54	III	+	-	-	-	-	-	A	Mo	T	-
2	48	III	+	-	-	-	-	-	A	Mo	T	-
3	61	III	+	-	-	-	-	-	A	Mo	T	-
4	49	III	+	-	-	-	-	-	A	Mo	T	-
5	53	III	+	-	-	-	-	-	A	Mo	T	-
6	59	III	+	-	-	-	-	-	A	Mo	Tp	-
7	44	III	+	+	-	-	-	-	A	Mo	T	-
8	64	II	-	-	+	-	+	+	B	Mo	Ts	-
9	39	III	+	-	-	-	-	-	A	Mo	T	-
10	47	III	+	-	+	-	-	-	A	Mo	T	-
11	49	III	+	+	-	+	-	-	A	Mo	T	-
12	37	III	+	-	-	-	-	-	A	Mo	T	-
13	48	III	-	-	+	-	-	-	A	Mo	Ts	+
14	56	III	+	-	-	-	-	-	A	Mo	T	-
15	31	II	+	-	+	+	-	-	A	M1	T	-
16	46	III	+	+	-	-	-	-	A	Mo	T	-
17	43	III	+	-	-	-	-	+	A	Mo	T	-
18	59	III	+	-	-	-	-	-	A	Mo	T	-
19	60	II	+	-	+	-	+	+	A	Mo	Tp	+
20	39	III	+	-	-	-	-	-	A	Mo	T	-
21	42	III	+	-	-	-	-	-	A	Mo	T	-
22	47	III	+	-	-	-	-	-	A	Mo	T	-
23	44	III	+	-	-	-	-	-	A	Mo	Ts	+
24	29	II	+	+	-	+	+	-	B	M1	T	-
25	38	III	+	-	-	-	-	-	A	Mo	T	-
26	49	II	+	-	+	-	-	-	B	M1	Ts	+
27	56	III	-	-	+	-	-	-	B	M1	T	-
28	51	III	+	-	-	-	-	-	A	Mo	T	-
29	49	III	+	-	-	-	+	+	A	Mo	T	-
30	39	I	+	-	+	+	+	+	B	M1	T	-
31	41	III	+	-	-	-	-	-	A	Mo	T	-
32	46	II	+	-	-	-	-	-	B	M1	Ts	+
33	48	III	+	+	-	+	-	+	A	M1	T	-
34	57	III	+	-	-	-	-	-	A	M1	T	-
35	55	II	+	+	+	+	+	+	B	M1	T	-
36	46	II	+	-	-	-	-	-	B	M1	T	-
37	45	I	+	net asse ssed	+	+	+	+	C	M2	Ts	-
38	59	III	+	-	-	+	-	-	A	Mo	Tp	+
39	39	III	+	+	-	-	-	-	A	Mo	T	-

40	44	II	+	-	-	-	-	+	A	Mo	Tp	+	
41	49	III	+	-	-	-	-	-	A	Mo	T	-	
42	52	II	+	+	+	-	-	-	A	Mo	T	-	
43	38	I	+	net assessed	+	+	+	+	B	M1	T	-	
44	40	II	+	+	-	-	-	-	B	M1	T	-	
45	37	I	+	+	+	-	+	+	A	Mo	Tp	+	
46	52	I	+	+	+	-	+	+	B	M1	Ts	+	
47	43	II	+	+	-	+	-		A	Mo	Ts	+	
48	39	II	+	net assessed	+	+	-	+	C	M2	T	-	
49	48	III	+	-	+	-	-	+	B	M1	T	-	
50	39	II	+	-	-	+	+	+	A	Mo	T	-	
51	42	II	+	+	+	-	-	-	A	Mo	Tp	+	
52	45	III	+	-	-	-	-	-	A	Mo	T	-	
53	37	II	+	-	-	+	+	+	A	Mo	Tp	+	
54	54	III	+	-	-		+	-	A	Mo	Tp	-	
55	51	II	-	-	+	-	-	-	A	Mo	T	+	
56	39	II	+	-	-	-	-	-	A	Mo	T	-	
57	54	III	+	-	-	-	-	-	A	Mo	T	-	
58	58	III	+	+	-	+	-	-	A	Mo	T	-	
59	64	III	+	-	+	-	-	-	A	Mo	Ts	-	

S.No 1 Surgical resection

Marked edema and Mass effect - M2

Age 2 Total - T

Edema and no mass effect M1

Sumptoms No

edema Mo

duration 3 Sub - total TS

HA 4 Partial - TP

Histlogical type 12

Fits 5 Sumptoms duration less than 1 month I

Fibrous F

FND 6 2 to 6 months II

Syncytial SL

GCS 7 More than 6 months III

Microcystic MC

CT Findigns / MRL 8 GCS

Fibro blastic FB

Surgical Resertion	9	15 -	A
Menigothelial			MT
RT	10	13, 14	B
Atypical meningioma			AT
Outcome	11	8 - 12	C
Angioblastic meningioma			AB
		Less than 8	D
Transtitional meningioma			TR
		CT Finding / MRI	

Outcome:

1. 100 - 10
2. 90 - 9
3 80 - 8
4. 70 - 7
5. 60 - 6
6. 50 - 5
7. 40 - 4
8. 30 - 3
9. 20 - 2
10. 10 - 1

13 LOCATIONS

C	-	Convexity
O	-	Olfactory
P	-	Parasagital
F	-	Falx
PT	-	Pterional
T	-	Tentorial
MS	-	Medial Sphenoid Wing

TABLE - 1

HISTOLOGICAL * AGE

Histological type	Age				
	< 40	**40-50**	**50-60**	**<60**	**Total**
Angioblastic meningioma	4	1	1		6
Atypical meningioma	2	3			5
Fibrous	1	5	4	3	13
Fibro blastic		1	2		3
Microcystic	2		1		3
Menigothelial	3	6	4		13
Syncytial	1	1	1		3
Transitional meningioma	2	7	4		13
Total	**15**	**24**	**17**	**3**	**59**

Fibrous, Menigothelial Transtitional were commonest fibroblastic microcystic syncytial least encounted angioblastic and a typical intermediate in occurrence.

TABLE - 2

HISTOLOGICAL TYPE * PREOPERATIVE HEADACHE

Histological type	Preoperative Headache		Total
	-	-	
Angioblastic meningioma	6		6
Atypical meningioma	5		5
Fibrous	12	1	13
Fibro blastic	2	1	3
Microcystic	3		3
Meningothelial	12	1	13
Syncytial	2	1	3
Transitional meningioma	13		13
Total	**55**	**4**	**59**

Heache was a predominant symptoms in all histological type however the argioblastic meningioma had severe headache of shorter duration while fibrous meningoma had mild - moderate headache of more than 6 months duration.

TABLE - 3

HISTOLOGICAL TYPE * PREOPERATIVE FITS CROSS TABULATION

Histological type	Preoperative Headache		Total
	-	-	
Angioblastic meningioma	4	2	6
Atypical meningioma	1	4	5
Fibrous	3	10	13
Fibro blastic	1	2	3
Microcystic	1	2	3
Menigothelial	3	10	13
Syncytial	1	2	3
Transitional meningoma	5	8	13
Total	**19**	**40**	**59**

Angioblastic meningioma more commonly manifested with fits. Fits were least commonly encounted in Fibrous type and meningothelial type.

TABLE - 4

HISTOLOGICAL TYPE * PREOPERATIVE AND CROSS TABULATION

Histological type	Preoperative Headache		Total
	-	-	
Angioblastic meningioma	3	3	6
Atypical meningioma	2	3	5
Fibrous	1	12	13
Fibro blastic	1	2	3
Microcystic		3	3
Menigothelial	3	10	13
Syncytial		3	3
Transitional meningioma	3	10	13
Total	**13**	**46**	**59**

Focal Deficit was commonest 50% of the patient in Angioblastic followed by a typical meningioma 40% of patient with a typical meningioma has focal deficit, 30% of the patient with meningothalial meningioma has FND. Focal mmeningical deficit was least in Fibrous meningioma only one in 13 had focal neurological deficit.

TABLE - 5

HISTOLOGICAL TYPE * SYMPTOM DURATION CROSS TABULATION

Histological type	Symptom duration			Total
	1 month	2-6 months	> 6 months	
Angioblastic meningioma	3	3		6
Atypical meningioma	1	2	2	5
Fibrous		1	12	13
Fibro blastic			3	3
Microcystic		2	1	3
Menigothelial		4	9	13
Syncytial	1		3	3
Transitional meningioma	2	6	6	13
Total	**5**	**18**	**36**	**59**

Angioblastic meningioma had the least duration of symptoms less than 1 month while the fibrous meningroma has symptoms of longest duration.

TABLE - 6

(LEVEL OF CONSCIOUSNESS)

HISTOLOGICAL TYPE * GLASSCOW COMA SCALE CROSS TABULATION

Histological type	Glasscow Coma Scale			Total
	15	13-14	8-12	
Angioblastic meningioma	2	3	1	6
Atypical meningioma	3	2		5
Fibrous	12	1		13
Fibro blastic	2	1		3
Microcystic	3			3
Menigothelial	11	2		13
Syncytial	3			3
Transitional meningioma	9	3	1	13
Total	**45**	**12**	**2**	**59**

More than 90% of patients with fibrous and meningothlial meningioma had a GCS of 15/15 patients with clouded consciousness was in Angiomatrous group (66.6%)

TABLE - 7

HISTOLOGICAL TYPE * CT_MRI CROSS TABULATION

Histological type	CT - MRI			Total
	Edema and no mass effect	Marked edema and mass effect	No edema	
Angioblastic meningioma	1	3	2	6
Atypical meningioma	3		2	5
Fibrous			13	13
Fibro blastic	1		2	3
Microcystic	1		2	3
Menigothelial	4		9	13
Syncytial			3	3
Transitional meningioma	5	1	7	13
Total	**15**	**4**	**40**	**59**

100% of the patient with Fibrous meningioma had no edema or mass effect on Radiological imaging, 66.6% of the Angioblastic meningioma had mass effect due to edema, of these 3/4 the had marked edema with mass effect post opperative FND - 25% improved when compared to 60% better out come in non FND 45% Deterioration when improved to only to 9% in Non FUND. very high correlation to better out come and Deterioration.

TABLE - 8

HISTOLOGICAL TYPE * SURGICAL RESECTION CROSS STABULATION

Histological type	SURGICAL RESECTION			Total
	Total	Partial	Subtotal	
Angioblastic meningioma	3	1	2	6
Atypical meningioma	3	1	1	5
Fibrous	10	1	2	13
Fibro blastic	3	-	-	3
Microcystic	3			3
Meningothelial	9	2	2	13
Syncytial	2		1	3
Transitional meningioma	9	3	1	13
Total	**42**	**8**	**9**	**59**

Total resection was commonly possible in Fibrous meningioma followed by Menigothelial and Transitional meningioma sub total or partial excision could only be achieved more commonly in Angioblastic and Atypical type.

TABLE - 9

HISTOLOGICAL TYPE * LOCATIONS CROSS TABULATION

Histological type							
	Convexity	**Falx**	**Medial Spenoid wing**	**Olfactory**	**Parasagital**	**Pterional**	**Tentorial**
Angioblastic meningioma		1	1		1	1	
Atypical meningioma	1	1		1		1	
Fibrous	9	1		1	2		
Fibro blastic	1				2		
Microcystic	1			1	1		
Meningothelial	4	2	1	1	4	1	
Syncytial	1			1	1		
Transitional meningioma	1	3	2	1	2	1	
Total	**18**	**8**	**4**	**6**	**13**	**4**	

In this study Fibrous meningioma was encounted most commnly at convexity Transitional was most common at the Falx, and medial sphenoid wing. Meningiothelial was more frequent at the parasagital area while all the pathological type were equally distributed in olfactory groove and pterional area.

TABLE 10

SYMPTON DURATION * OUTCOME CROSS TABULATION

		OUTCOME			**Total**
		Deterioration	**Static**	**Improved**	
Sympton	< 1 months	3	1	1	5
Duration	2-6 months	4	7	7	18
	> 6 months	4	11	11	36
	Total	**11**	**19**	**29**	**59**

Most of the patients with longer duration of symptoms prior to surgery improved.

TABLE - 11

GLASSCOW COMA SCALE * OUTCOME CROSS TABULATION

		OUTCOME			Total
		Deterioration	**Static**	**Improved**	
Glasscow	15	7	13	25	45
Coma scale	13, 14	2	6	4	12
	8 -12	2			2
Total		**11**	**19**	**29**	**59**

TABLE - 12

AGE * OUTCOME CROSS TABULATION

		OUTCOME			Total
		Deterioration	**Static**	**Improved**	
Age	<40	5	1	9	15
	40 - 50	4	10	10	24
	50 - 60	2	6	9	17
	> 60		2	1	3
Total		**11**	**19**	**29**	**59**

Maximum % of patients with younger age group < 40 years Deterioration in karnufsky scale while best result were obtained in 5 - 6 decades.

TABLE 13

HEADACHE

Histology type	Histology	Headache	Cross Tab not assessed
Fibrous	76%	23%	-
Meningothelial	84.6%	15.4%	-
Syncytial	100%	-	-
Microcystic	100%	-	-
Fibroblastic	33%	66.6%	-
Atypical	80%	20%	-
Angioblastic	Nil	71.4%	28.5%
Transitional	70%	20%	10%

Persistent Headache was common in angioblastic Meningioma followed by

Fibroblastic Meningima.

Persistent Headache was Least common in Fibrous type.

TABLE 14

FITS

Total	Histological type	No Fits	Improved	Static	Deteriorate
13	Fibrous	11	2	-	-
3.	Syncytial	2	1	-	-
3.	Microcystic	1	1	-	-
3.	Fibroblastic	2	1	-	-
13	Meningothelial	10	2	-	-
5	Atypical	3	-	1	1
6	Angioblastic	2	2	2	-
13	Transitional	8	3	2	2

Among the patient who had pre operative Fits in angioblastic type 50% of patients had seizure even with antiepileptic drugs.

None of the patients with Fibrous and Syncytial type had post operative Fits.

TABLE 15

FND

Total	Histological type	No FND	Improved	Static	Deteriorate
13	Fibrous	12	-	-	-
3.	Syncytial	3	-	-	-
3.	Microcystic	3	-	-	-
3.	Fibroblastic	3	-	-	-
13	Meningothelial	9	2	1	1
5	Atypical	2	-	1	1
6	Angioblastic	2	-	3	1
13	Transitional	8	-	3	2

Post Operative FND common in Angioblastic and atypical Meningioma.

Almost all these patients had post operative Neurological Deficit.

TABLE - 16

CT_MRI * OUTCOME CROSS TABULATION KARNUFSKY SCALE

Count

		Outcome			Total
		Deterioration	Static	Improved	
CT_MRI	Edema and no mass effect	3	5	7	15
	Marked edema and mass effect	4			4
	No edema	4	14	22	40
Total		11	19	29	59

Maximum Number of patient with improvement belonging to the no edema group

All patients with mass effect had deterioration

50% of the patients wish edema alone improvement 20% had deterioration

TABLE - 17

LOCATIONS * OUTCOME CROSS TABULATION

		Outcome			Total
		Deterioration	Static	Improved	
Location	Convexity		4	14	18
	Falx	1	6	1	8
	Medical Sphenoid Wing	4			4
	Olfactory		1	5	6
	Parasagital		4	9	13
	Pterional	2	2		4
	Tentorial	4	2		6
Total		11	19	29	59

Overall 50% of patient had better out come > 70% of convexity 01 factory parasagital better our come highest < 7% convexity poor outcome in medial sphenoid wing meningioma tentorial with all patients of medial sphenoid wing poor out come.

TABLE - 18

CT_MRI * OUTCOME CROSS TABULATION

KARNUFSKY SCALE

		Outcome			Total
		Deterioration	Static	Improved	
CT_MRI	Edema and no mass effect	3	5	7	15
	Marked edema and mass effect	4			4
	No edema	4	14	22	40
Total		**11**	**19**	**29**	**59**

66% of Angioblastic mningioma in Karnufsky scale 20% A typical meningioma deteriorated 2/3 of patient with Fibrous meningioma improved while 1/3 rd remain static in the Transitional, all the transitional deferiorated static and improvement was equally distributed.

TABLE - 19

SURGICAL RESECTION * OUTCOME CROSS TABULATION

WITH KARNUFSKY SCALE

		Outcome			Total
		Deterioration	**Static**	**Improved**	
Surgical	Total	5	12	25	42
Resection	Partial	4	1	3	8
	Sub Total	2	6	1	9
Total		**11**	**19**	**29**	**59**

Patient with total resection commonly improved 25 out of 42 50% of patients with partial resection deteriorated 2/5 mostly patient with sub total resection remain status

TABLE - 20

RADIO THERAPY * OUTCOME CROSS TABULATION

KARNUFSKY SCALE

		Outcome			Total
		Deterioration	**Static**	**Improved**	
Radio Therapy	+	5	7	4	16
	-				
Total		11	19	29	59

RT was given for malignant variety 7 remain static slightly more than while 25% of improved and 50% of non Radio therapy improved can not be assessed all Radio therapy did not have total removal 25% deteriorated.

DISCUSSION

TABLE 1

It is seen in this study that Angioblastic Meningioma and Atypical Meningioma though rate they occur in the younger age groups of patients less than 40 years, as age advanced the patient present with benign type of Meningioma more commonly in the exception of Fibroblastic which tend to occur in 5-6 decades.

TABLE 2

Though Headache was common presentation in this study the malignant group had score Headache of lesser duration benign tumour had mild to moderate longer duration with fibrous type having Headache more than 6 months commonly.

TABLE 3

Malignant Meningioma was presented with pre operative seizure 66%.

TABLE 4

Focal Neurological deficit most commonly occur in Tumour in invasive malignant in nature is less frequently encounted in benign type. This indicate the extend of surrounding cortical invasion by the Tumour.

TABLE 5

Malignant type of Meningioma (Angioblastic Meningioma) has severe symptoms of shortest duration (severe Headache, FND less than 1 month) while beingn type had longested duration for e.g. Fibrous Meningioma presented with moderate Headache of more than 6 months with FND. This again serves indicating the invasive nature of Meningioma.

TABLE 6

Almost all the patient had relatively good GCS by benign type. Fibrous meningioma had GCS of 15/15 more than 90% of times the malignant Angioblastic variety had coulded consciousness in 60.6% of the patients. This again indicative pf invasion of cortex and surrounding edema.

TABLE 7

Benign meningioma like fibrous type do not have edema in CT while by the evidence of malignant variety Angioblastic meningioma had commonly marked edema. This account for commonly seen FND more score Headache in pathological type associated with edema in imaging.

TABLE 8

Total excision was possible in benign type of meningioma like fibrous because of reduced vascularity and devage. Total resection was not possible in more often that not in Angioblastic because of increased vascularity and lack of plane of devage.

TABLE 9

In this study fibrous meningioma was encounted most commonly at convexity transitional over most commonly at the falx and medical sphenoidal wing meningothelial was more frequent at the parasagital area while all the pathological type were equally distributed in OlFactory groove and pterioral area.

TABLE 10

Interestingly most of the patients with longer duration of symptoms prior to surgery improved while those with lesser duration deteriorated more. This can be explained by the fact that most of the patient with longer duration had benign those patient present with lesser duration of symptoms had malignant variety Angioblastic meningioma.

TABLE 11

Patients with eluded consciousness who had malignant type of meningioma most commonly deteriorate following surgery, while patient with GCS 15/15 had benign meningioma improved with surgery.

TABLE 12

Similarly maximum % of patient with younger age group < 40 deteriorated. Apparently paradoxically those in 5-6 decades had improved clinically. This is because the younger age group had malignant invasion while 5-6 decade had relatively benign type.

TABLE 13

Persistent Headache following surgery was common in invasive type of meningioma like Angioblastic type. Most patient with fibrous meningioma had completely relief following surgery. This again point to the dural or malignant variety.

TABLE 14

Persistent of seizure was most commonly in Angioblastic form whose 50% had difficulty in controlling of seizure none of the syncytral type fibrous had seizure post operative period. This again correlate with malignant with benign nature of later.

TABLE 15

Most of patients with invasive meningioma had neurological deficit following surgery.

TABLE 16

Maximum Number of patients with improvement in Karnofsky scale had no edema in the imaging study. Among the patient had edema without mass effect on CT 50% improvement 25% Deteriorate. All patients with mass effect on CT 1MRI had deterioration.

It is already noted that edema and mass effect associated with malignant variety of meningioma.

TABLE 17

Over all 50% of patient had better out come. 7.70% of convexity, ol Factory parasagital better out come. Highest 77% convexity poor outcome in Medical sphenoid with meningioma Tentorial with all patients of Medical sphenoid wins poor outcome.

TABLE 18

6% of Angioblastic miningioma in karnofsky scale 20% Atypical meningioma deteriorated 2/3 of patient with Fibrous meningioma improved while 1/3rd remain static in the transitional all the transitional deteriorated static and improvement was equally distributed.

TABLE 19

Patient with total resection commonly improved 25 out of 42 50% of patients with partial resection deteriorated. 2/5th mostly patient with subtotal resection remain statistic.

TABLE 20

In this study fibrous meningioma was encounted most commonly at convexity transitional over most commonly at the falx and medial sphenoidal using meningothelial was more frequent at the parasagital area while all the pathological type were equally distributed in OlFactory groove and pterioral area.

GROSS STUDY

TABLE 18A

HISTOLOGICAL TYPE Vs OUTCOME

Histological type	N	Admission		Discharge	
		Mean	SD	Mean	SD
Fibrous**	13	88.46	9.87	97.69	5.99
Angioblastic meningioma	4	58.33	11.69	60.00	16.33
Atypical meningioma	5	70.00	7.07	72.00	14.83
Fibroblastic	3	80.00	10.00	93.33	5.77
Microcystic	3	76.67	15.28	96.67	5.77
Menigothelial*	13	77.69	8.32	86.92	10.32
Syncytial	3	80.00	10.00	93.33	5.77
Transitional menigioma	11	67.69	13.63	71.82	18.88

* $p < 0.05$; ** $p < 0.01$ (Paried t-test)

TABLE 18B:

LOCATION Vs OUTCOME

Location	N	Admisssion		Discharge	
		Mean	SD	Mean	SD
Convexity**	18	83.89	10.92	98.33	3.83
Falx	8	70.00	10.69	67.50	14.88
Medial Spheniod Wing	1	80.00	20.62	70.00	.
Olfactory**	6	75.00	5.48	90.00	8.94
Parasagital**	13	78.46	14.63	90.00	7.07
Pterional	4	72.50	5.00	67.50	9.57
Tentorial	5	64.00	10.49	56.00	11.40

* $p < 0.05$; ** $p < 0.01$ (Paried t-test)

TABLE 18C:

EXTEND OF RESECTION Vs OUTCOME

Surgical resection	N	Admission		Discharge	
		Mean	SD	Mean	SD
Total**	39	78.21	12.54	88.46	13.68
Partial	8	72.50	14.88	71.25	25.32
Subtotal	8	75.00	9.26	77.50	13.89

** $p < 0.01$ (Paried t-test)

Table 19 - A

CASE SUMMARIES
PARTIAL EXCISION Vs PATHOLOGICAL TYPE

S.No	LOCATION	Histological type		Admission	Discharge
I	Convexity	Fibrous	N Mean Std. Deviation	1 100.00	1 100.00
		Total	N Mean Std.Deviation	1 100.00	1 100.00
II	Falx	Tranisitional Menigioma	N Mean Std.Deviation	1 70.00	1 70.00
		Total	N Mean Std.Deviation	1 70.00	1 90.00
IV.	Olfactory	Menigothelial	N Mean Std. Deviation	1 80.00	1 100.00
V	Parasagital	Menigothelial	N Mean Std.Deviation	1 6.00	1 80.00
	total		N Mean Std. Deviation	1 60.00	1 80.00
VII	Tentorial	Angioblastic meningioma	N Mean Std. Deviation	1 60.00	1 80.00
		Atypical menigioma	N Mean Std. Deviation	1 50.00	1 40.00
		Transitional menigioma	N Mean Std. Deviation	1 80.00	1 50.00
		Total	N Mean Std. Deviation	3 66.67 15.275	3 53.33 15.275

a. Resection = partial

Table 19 - B

SUB TOTAL EXCISION Vs PATHOLOGICALTYPE

S.No	LOCATION	Histological type		Admission	Discharge
I	Convexity	Fibrous	N Mean Std. Deviation	1 70.00	1 100.00
		Syncytial	N Mean Std.Deviation	1 90.00	1 90.00
		Total	N Mean Std.Deviation	2 80.00 14.142	2 95.00 7.071
II.	Falx	Angioblastic meningioma	N Mean Std.Deviation	1 60.00	1 60.00
		Menigothelial	N Mean Std. Deviation	1 80.00	1 80.00
		Total	N Mean Std.Deviation	2 70.00 14.142	2 70.00 14.142
III.	Medical Spheniod wing	Tranisitional Menigioma	N Mean Std.Deviation	1 40.00	Death
		Total	N Mean Std. Deviation	1 40.00	Death
IV	Olfactory	Firbous	N Mean Std. Deviation	1 80.00	1 80.00
		Total	N Mean Std. Deviation	1 80.00	1 80.00
VI	Pteional	Angioblastic meningioma	N Mean Std. Deviation	1 70.00	1 60.00
		Menigothelial	N Mean Std. Deviation	1 80.00	1 80.00
		Total	N Mean Std. Deviation	3 73.33 5.774	3 70.00 10.000

a. Resection = Subtotal

CASE SUMMARIES

TOTAL EXCISION Vs PATHOLOGICAL TYPE

S.No	LOCATION	Histological type		Admission	Discharge
I	Convexity	Fibrous	N Mean Std. Deviation	7 88.57 8.997	7 100.00 000
		Atypical meningioma	N Mean Std.Deviation	1 80.00	1 100.00
		Fibroblastic	N Mean Std.Deviation	1 80.00	1 100.00
		Microcystic	N Mean Std.Deviation	1 60.00	1 100.00
		Menigothelial	N Mean Std.Deviation	4 80.00 8.165	4 97.50 5.000
		Total	N Mean Std.Deviation	15 83.33 10.465	15 98.67 3.519
II	Falx	Firbous	N Mean Std.Deviation	1 90.00	1 90.00
		Atypical meningioma	N Mean Std.Deviation	1 60.00	1 70.00
		Menigothelial	N Mean Std.Deviation	1 70.00	1 70.00
		Tranisitional Menigioma	N Mean Std.Deviation	2 65.00 7.071	2 65.00 7.071
		Total	N Mean Std.Deviation	5 70.00 12.247	5 72.00 10.954
III.	Medial Spheniod Wing	Angioblastic meningioma	N Mean Std.Deviation	1 40.00	Death
		Menigothelial	N Mean	1 80.00	1 70.00

			Std.Deviation		
		Tranisitional Menigioma	N Mean Std.Deviation	1 70.00	Death
		Total	N Mean Std.Deviation	3 70.00 20.817	1 6.66
IV		Atypical meningioma	N Mean Std.Deviation	1 70.00	1 60.00
		Microcystic	N Mean Std.Deviation	1 80.00	1 100.00

LOCATION Vs RESECTION

		Surgical Resection					
		Total		Parital		Subtotal	
LOCATION		Admission	Discharge	Admission	Discharge	Admission	Discharge
Convexity	N	15	15	1	1	18	18
	Mean	83.33	98.67	100.00	100.00	83.89	98.33
	SD	10.47	3.52	.	.	10.92	3.83
Falx	N	5	5	1	1	8	8
	Mean	70.00	72.00	70.00	40.00	70.00	67.50
	SD	12.25	10.95	.	.	10.69	14.88
Medial Sphenoid Wing	N	3	1	2	2	4	1
	Mean	63.33	70.00	75.00	95.00	57.50	70.00
	S D	20.82	.	7.07	7.07	20.62	.
Olfactory	N	3	3	1	1	6	6
	Mean	73.33	90.00	60.00	80.00	75.00	90.00
	S D	5.77	10.00	.	.	5.48	8.94
Parasagital	N	12	12			13	13
	Mean	80.00	90.83			78.46	90.00
	S D	14.14	6.69			14.63	7.07
Pterional	N	1	1	3	3	4	4
	Mean	70.00	60.00	66.67	53.33	72.50	67.50
	S D	.	.	15.28	15.28	5.00	9.57
Tentorial	N	3	2			6	5
	Mean	63.33	60.00			65.00	56.00
	S D	5.77	0.00			10.49	11.40

FUNCTIONAL OUTCOME

I. CONSIDERING CONVEXITY MENINGIOMA

Convexity Meningioma total resection of the tumour had average increase of 15.34% in the Karnopsky scale following surgery. Among various pathological type fibrous meningothelial transitional reached the full functional capacity following surgery.

Atypical meningioma on the convexity following total resection had the least improvement reaching the karnofsky scale 19% after 6 months.

Among the convexity Meningioma which had gone subtotal resection there was no increase in karnofsky score, there was average increase 15% after 6 months.

Among the various pathological type fibrous meningothelial has maximum improvement in karnofsky scale following resection.

In partial excision of the convexity meningioma which was done only one case in this serious. There was no statistically significantly increase in functional outcome.

II. TAKING THE FALX MENINGIOMA NEST :

Total excision Achieved, there was an average in increase karnofsky scale of following surgery as per statistical Analysis.

Among the various subtype Atypical Meningioma has maximum increase in karnofsky score, fibrous meningothelial and transitional type did not show any substantial improvement in pre operative and post operative period.

In case of subtotal resection of falx meningioma again an average, there was no increase in pre and post operative karnopsky score. This concluded both Angioblastic and Menigothelial type which was excluded in this study.

In case if partial resection of falx Meningioma, there was Detoriation Following surgery.

III. Taking into the consideration medical sphenoid wing meningioma those undergoing total excision had average in karnofsky score 6.6%.

The pathological type encounted in the category of which Angioblastic and Meningothelial and Transtitional type of Meningioma dred.

Sub total excision of medical sphenoid wing Meningioma which was transitional type in this study also resulted in death. There was no partial resected sphenoid wing Meningioma in this study.

IV. Among the Olfactory groove meningioma under going total excision there was an average increase of 16.67 in the karnopsky score as per the statistical method used.

V. Among the pterional Meningioma there was average deterioration of 5.54 statistically irrespective of the total subtotal and partial resection among the various pathological sub group Angioblastic Meningioma deteriorate rapidly followed by Atypical Meningioma.

Among microcstic Meningioma had maximum outcome in 80-100%.

Atypical Meningioma has raise of 70-80 in Karonofsky score.

Subtotal excision of olfactory groove Meningioma did not statistically improve the functional outcome. Only one case of Fibrous Meningioma improved in the study.

Partial excision of OlFactory groove Meningioma shows an average increase 20% Karonofsky score statistically.

There were 2 case in this category and transitional Meningioma patient had better outcome than Meningothelial Meningioma.

VI. Among the parasagital Meningioma total excision of tumour among one Histological type had statistically increase of 10.83%.

VII. Among the pterional Meningioma there was average deterioration of 5.54% karonofsky score statistically. Irrespective of total subtotal and partial resection among the various pathological subgroups Angioblastic Meningioma deteriorate rapidly followed by Atypical Meningioma. Meningothelial Meningioma remain statusco.

VIII. Teritorial Meningioma deteriorate an average 6.16 on the karofsky score statistically.

Among the pathological type asain Angioblastic Meningioma deteriorate wrist followed by atypical Meningioma.

These deterioration was seen in Transitional Meningioma.
Without reference to the location and resection :

I. Correlating the Histological type of Meningioma with functional outcome as determined by Karonofsky table was done using paried t-test Table 1 which is seen that fibrous Meningioma has the maximum improvement in the functional outcome with a value of less than 0.01 foctmed by Menigothelial Meningioma P value of less than 0.05 worst outcome was witnessed in Angioblastic and Atypical Meningioma.

Similarly correlating the Functional outcome and location of the Tumour without reference to Histological type or Tumour resection using paried t Test Table. Good outcome was seen in convexity and parasagital, OlFactory P value less than (0.00) with result obtained by convexity may followed by para sagital Meningioma followed by OlFactory groove Meningioma.

II. Correlating the Surgical Resection with Functional outcome using paried t Test table again irrespective of the Pathological type of Tumour resection showed best outcome for total surgical resection P value 1 T, value less than 0 followed by subtotal and partial resection.

III. On further define in the data on Analysing the outcome taking into account location of the tumour and extend of Tumour resection for each pathological type encounted in this study following observation made.

CONCLUSION :

1. Patient with younger age group had invasive type of meningioma while older age group non invasive type of meningiomas are common.

2. Headache was more severe in shorter duration in malignant variety while symptoms was mild to moderate in benign variety.

3. Angioblastic meningioma (malignant variety) predominantly manifested with Fits. Fits occurs with lesser frequency in fibrous type of meningioma.

4. Focal Neurological deficit were more common in malignant type Angioblastic variety most offender followed by Typical meningioma focal neurological deficit was least in fibrous.

5. Malignant type of meningioma like Angioblastic had the least duration of symptoms before surgery. Patient presenting to the Neurosurgeon fibrous meningio had longer duration.

6. Before consulting the Neurosurgeon for opinions in the absence of seizure patient with benign tuype of meningioma was fully alert at the time of diagnosis while who was malignant variety present with clouded consciousness.

7. Patient with benign meningioma like syncytial meningioma had no surrounding edema with effect in imaging study. Patient with malignant variety had edema and mass effect in the imaging study.

8. Total resection was more commonly possible in fibrous meningioma. Meningothelial meningioma and transitional meningioma. Angioblastic and Atypical type only partial or subtotal resection possible.

9. Most of the patient with benign variety who had long duration of symptoms improved very significantly Karnofsky scale following surgery, on other hand patients with Angioblastic inspite of least duration of symptoms pro operatively deteriorate in Karnofsky scale post operatively.

10. Patients with good GCS either improved or static in the Karnofsky scale post operatively. This patient had benign type of meningioma as fibrous type. Patient with lower GCS particularly between 12+15 deteriorated post operatively.

11. Patients with younger age group deteriorate in Karnopskyn scale post operatively because of the malignant type of meningioma while old age benign variety is common very faired well in Karnopsky scale.

12. Relief of Headache was most noticeable in fibrous, syncyntal meningothelial meningioma, persistant post operative Headache commonly present in Angioblastic followed by fibroblastic meningioma.

13. Persistent of post operative Fits inspite of Anticonvulsant, Headache common in malignant type of meningioma like Angioblastic variety. None of the patient with fibrous syncyntial had post operative seizure.

14. Post operative FND worsening or persisted again more common in invasive type, Fibroblastic followed by Atypical Meningioma.

15. Post operative Karnofsky scale and Radiological findings all patient with edema and mass effect deteriorate in Karnofsky scale.

16. Medial sphenoid wing meningioma had poor outcome from location point of view more so if total excision was attempted here irrespective of pathological type. Tentorial meningioma again had poor functional outcome particularly total excision was attempted irrespective of pathological outcome. Best result was achieved by convexity followed by parasagital OlFactory groove meningioma.

17. Among the pathological type Angioblastic meningioma had worst prognosis irrespective of location. This was followed by Atypical Meningioma in poor prognsis. Fibrous Meningioma had best on functional outcome following surgery syncytial, menigothlial meningioma were in between.

18. Radiotheraphy for malignant malingioma had functional improvement in 25% of case 50% of patient remain static 25% deteriorate.

BIBLIOGRAPHY

References:

S.No.1

J.Neurosurg. 1984 Jan;60 (1) : 52-60. Related Articles, Links.

Morbidity, mortality, and quality of life following surgery for intracranial meningiomas. A retrospective study in 257 cases.

S.No.2

Aust N Z J Surg. 1996 Mar; 66 (3) : 144-50. Related Articles, Links.

Factors affecting morbidity and mortality following surgical intervention in patients with intracranial meningioma.

S.No.3

Neurochirurgie. 1986; 32 (2) : 129-34. Related Articles, Links

[Outcome of intracratial meningioma in adults. Retrospective study of a medicosurgical series of 161 meningiomas]

[Article in French]

S.No.4

Neurosurg Rev. 1998; 21 (2-3) : 106-10. Related Articles, Links

Intracranial meningiomas. Analysis of 344 surgically treated cases.

Altinors N, Gurses L, Arda N, Turker A, Senveli E, Donmez T, Sanli M, Bavbek M, Cancer H.

Neurosurgery Department, Baskent University, Ankara, Turkey.

nura@h.baskent.edu.tr

S.No.5

J Neurosurg. 1996 Mar; 84 (3) : 382-6. Related Articles, Links.

Incidence of seizures after surgery for supratentorial meningiomas : a modern analysis.

S.No.6

Mayo clin Proc. 1998 Oct; 73 (10) : 936-42. Related Articles,Links.

Primarily resected meningiomas: outcome and prognostic factors in 581 Mayo Clinic patients, 1978 through 1988.

S.No.7

Acta Neurochir (Wien). 1988; 90 (3-4) : 121-3. Related Articles, Links.

Intracranial meningioma in the elderly (over 70 years old). A retrospective study of 30 surgical cases.

S.No.8

Epilepsy Res. 2000 Jan; 38 (1) : 45-52. Related Articles, Links.

Intracranial meningiomas and epilepsy: incidence, prognosis and influencing factors.

S.No.9

J Neurooncol. 1992 Jun; 13 (2):177-81. Related Articles, Links.

Quality of life in patients with intracranial tumors on the basis of Karnofsky's performance status.

S.No.10

J Neurosurg. 1962; 6(2) : 131-7. Related Articles, Links.

Intracranial Turmors in the elderly : effect (13) of age on the outcome of First time surgery for meningioma.

S.No.11

Atypical and malignant meningiomas : an outcome report of seventeen cases.

Coke CC, Corn BW, Werner-Wasik M, Xie Y, Curran WJ Jr.

Department of Radiation Oncology, Thomas Jefferson University Hospital, Philadelphia, Pennsylvania 19107, USA.

S.No.12

Br J Neurosurg. 1992; 6 (2) : 131-7. Related Articles, Links.

Intracranial tumours in the elderly: the effect of age on the outcome of first time surgery for meinngiomas.

S.No.13

Wshing H, Eisenhardt L; Meningiomas. Their classifications Regional Behaviour Life History, and Surgical End Results. Springfidd, IL, Charles C.Thomas, 1938)

S.No.14

Peritumoral Brain Edema in Intracranial Meningiomas: Effects of Radiological and Histological Factors. Neurosurgery. 49(5):1046-1052, November 2001.

Tamiya, Takashi M.D; Ono, Yasuhiro M.D.; Matsumoto, Keygo M.D.; Ohmoto, Takashi M.D.

S.No.15

Neurosurgery. 2005 May; 56(5):946-55; discussion 946-55.

Growth pattern changes of meningiomas: long-term analysis.

Nakasu S, Fumami T, Nakajima M, Watanabe K, Ichikawa M, Matsuda M.

Department of Neurosurgery, Shiga University of Medical Science, Ohtsu, Shiga, Japan. Snakasu@belle.shiga-med.ac.jp.

S.No.16

Guthrie BL, Ebersold MJ, Scheithauer BW: Neo;lasms of the intracranial meninges. In: Neurological Surgery. (Ed.) Youmans JR. WB Saunder 1990. p.3250.

S.No.17

MacCarty CS, Taylor WF: Intracranial meningiomas: Experiences at the Mayo Clinic. Neurol Medico Chir 19: 569, 1979.

S.No.18

Mirimanoff RO, Dosoretz DE, Linggood RM, et al:Meningioma: Analysis of recurrence and progression following neurosurgical resection, J Neurosurg 62:18, 1985.

S.No.19

Kallio M. Sankila R, Hakulinen T, et al: Factors affecting operative and excess long term mortality in 935 patients with intracranial meningioma. Neurosurgery 31:2, 1992.

S.No.20

Sindou MP, Alaywan M: Most intracranial meningiomas are not cleavable tumors: Anatomic – Surgical evidence and angiographic predictability. Neurosurgesry 42:476-480, 1998.